formation stored on the magnetic tape. The speed of the belt **10** is controlled by variable speed control **22**.

Magnetic tape **28** is stored on a tape supply reel **29** and is threaded around a capstan **31**, pinch wheel **32**, past tape head **33** and around idler wheel **35** to tape takeup reel **36**.

A tape-driving mechanism consists of a idler arm **38** which contains idler wheels **39** and **40** and braking wheels **43** and **44**. A drive wheel **46** coupled to drive motor **47** is also provided. A rubber belt **49** extends around drive wheel **46**, idler wheel **39**, brake wheels **43** and **44** and idler wheel **40**. The length of rubber belt **49** is such that it is under tension when it is placed in the position shown. A pivot **51** positions the idler arm **38** and the tension of the rubber belt **48** pulls arm **38** against reels **29** and **36** so that belt **49** hugs the periphery of the magnetic tape on takeup reel **36** and tape supply reel **29**.

In operation, motor **47** drives drive wheel **46**, moving the rubber belt **49** in a direction so as to unwind the tape from one reel and wind up the tape on the other reel. This direction is reversible to provide fast forward or fast reverse movement of the tape.

Braking wheels **43** and **44** act to provide a drag on the rubber belt **49**. Assuming that the tape is on tape supply reel **29** and is being received by takeup reel **36**, motor **47** would turn drive wheel **46** in a clockwise direction. Belt **49**, frictionally engaged with the periphery of tape **28** on tape supply reel **29**, would cause the tape to be unwound from this reel. The friction between belt **49** and the tape on takeup reel **36** will cause takeup reel **36** to wind up the tape. With the tape moving in the direction indicated, the portion of the rubber belt between braking wheels **43** and **44** and drive wheel **46** around idler wheel **40** is stretched while the portion of belt **49** between drive wheel **46** and braking wheels **44** and **43** is relaxed around idler wheel **39**. This alternate stretching and relaxation of the belt drive will cause the rubber belt to move takeup reel **36** at a slightly faster rate than is required to receive the tape unwound from supply reel **29**. Thus the drive mechanism will automatically adjust to remove any slack from the magnetic tape. If drive wheel **46** is rotated in the opposite direction, that is, counterclockwise, tape is removed from reel **36** and received by reel **29**. In this case, the portions of belt **49** which are under tension and which are relaxed are reversed so that reel **29** tends to rotate at a slightly faster rate than reel **36** so that all slack in the magnetic tape will be removed in the reverse operation also.

When tape characters are being read from magnetic tape **28** in other than the indexing mode of operation, pinch wheel **32** is moved by arm **30** against capstan **31** so that tape **28** is controlled by capstan **31**. In this mode of operation, motor **47** is nearly stalled and only turns enough to transport the tape pulled by the capstan from one reel and wind it on the other reel. Motor **47** is of a type that will not be damaged when operated in a stalled condition. Power for capstan **31** is provided from motor **18** through helical gears **53** and **54**. Helical gear **54** is coupled to shaft **56** through clutch **58**. Shaft **56** is coupled to capstan **31** and a brake **59** is coupled to shaft **56** to stop the shaft when required. In operation, the control logic and timing signals from a magnetic track on belt **10** cooperate to intermittently energize and deenergize clutch **58** and brake **59** to provide intermittent tape motion. When clutch **58** is disengaged; brake **59** is energized to stop the movement of the capstan. When clutch **58** is engaged, brake **59** is deenergized to permit capstan rotation.

As tape **28** moves past tape head **33** the information stored on tape **28** is read off and applied to the control logic for use thereby. Information from the control logic is applied to solenoids **64** to set the bubbles on belt **10** in a desired pattern. The timing signals are read from belt **10** by a tape head **61**. Variable speed control **22** is set by the operator so that belt **10** will move at a desired speed.

Referring to FIG. **2**, there is shown a side view of the belt mechanism. Belt **10** is wound around wheels **11** and **12**, **14** and **15** in the manner previously described. The top portion of belt **10**, upon which is counterbalanced by counterweight **67** so that it is normally in the raised position shown. When the operator rests his fingers on belt **10**, shelf **66** is depressed to position **66***a*, shown in dashed lines, and remains in this position until the operator removes his hands from the belt. Depressing shelf **66** to position **66***a* causes bracket **69** to actuate miniature switch **70** to start the operation of the machine. Wheel **14** holds belt **10** under tension under pressure from spring **72**. The pressure on belt **10** from wheel **14** against wheel **12** acts to depress all of the raised bubbles to the inside of belt **10**, thus presetting belt **10** for the desired pattern formation by solenoids **64**.

Referring to FIG. **3**, there is shown a section of belt **10**. A pair of solenoids **74** and **75** which are used to set the bubbles on the belt in the desired position are also shown. In this example the bubbles to the left of the solenoids are all set in the raised or concave position shown and are stable in this position. (Concave to the person reading the belt.) In the example, solenoid **75** has been operated to depress bubble **76** to a lower or convex position, while bubble **77** remains unchanged as solenoid **74** is not operated. Bubbles **80** and **81** have been previously depressed by the operation of solenoids **74** and **75**.

Belt **10** is formed of a plastic material such as polypropylene and the bubbles are molded therein. The molded bubbles are bistable, that is, they will remain in the convex or concave position, such as is exemplified by bubbles **77** and **76**, until forcibly moved to the other position. Thus the raised pattern on belt **10**, exemplified by bubbles **76**, **80** and **81**, remains on the belt as it passes under the fingers of the operator until these bubbles are pushed to their opposite position by the pressure of wheel **14** on wheel **12** (FIG. **2**).

Referring to FIG. **4**, there is shown the pattern of bubbles which is impressed on belt **10**. Belt **10** has a series of groups of six bubbles **84** which can be used to form any braille character. Braille characters are formed by one or more of the six positions **83** being moved to a raised or convex position. The use of six positions permits all **63** braille characters to be formed. A magnetic track **85** is also formed on belt **10** and includes timing marks **86** at desired positions in the belt to provide a trigger pulse to the logic when the bubble pattern is properly aligned with the solenoid-actuating mechanism as the belt **10** moves past this mechanism. When a trigger pulse is received, the desired solenoids are actuated to set up a character. Clutch **58** (FIG. **1**) is energized to advance tape **28**, causing a new character to be read and stored in the machine logic. During reading, belt **10** moves continuously to present the braille patterns to the operator.

FIG. **5** shows the pattern on the magnetic tape **28** of FIG. **1**. The magnetic tape contains portions **88** which are reserved for note characters, portions **89** reserved for book characters and portions **90** reserved for indexing characters. The book characters **89** are characters which have been placed on the tape during the prerecording of the tape. These characters may be obtained from ink-printing typesetting tapes which have been translated into braille language or manual translations of ink print material. This presupplied information, while designated as book characters, is not necessarily the output of a book, but may be any kind of reading material.

Index characters **90** are supplied so that the operator can find any desired portions of the tape. Preset switches indicate the desired indexing mark and the tape is rapidly searched until an index character corresponding to the switch setting is found. At this point, the tape is stopped automatically and the operator, after returning the machine to the reading mode, is presented with the exact portion of the tape desired.

Note characters **88** are spaces provided on the magnetic tape where notes can be written so that the tape can be annotated as desired by the operator. It should be noted that a tape containing only note characters can be written by the machine operator and can be read by another machine operator.

An enlarged portion of the note characters portion **88** is shown with a series of note characters **93**, **94**, and **95**. This illustrates that an arbitrary number of note character portions